

TODAYS LESSON

Title: Understanding the functions and food sources of nutrients required for optimal health and development of youth

-Macronutrients

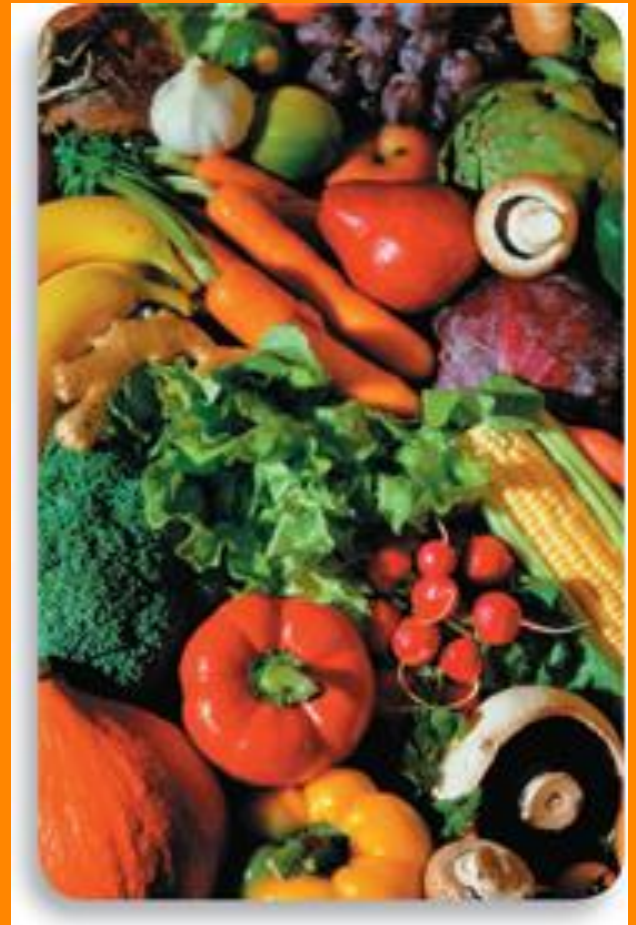
Success Criteria:

I understand the functions and food sources of macronutrients required for the optimal health and development of youth

Whenever we eat, the foods are broken down in the process of digestion to release the nutrients. These nutrients are then used by the body for many functions related to development including the production of energy and blood and the development of hard and soft tissues

Some foods have more nutrients in them than others, and some have nutrients that other foods may not have at all. The best way to maintain a balanced diet is to eat a wide variety or many different types of foods.

FIGURE 4.2 Eating a range of foods is the best way to ensure adequate nutrition.



- There are six categories of nutrients that are needed for optimal health and development. They are:
- carbohydrates (including fibre)
- protein
- lipids/fats
- vitamins
- minerals
- water.

- Carbohydrates, protein and lipids are needed by the body in large amounts and are often called **macronutrients**, while vitamins and minerals are called **micronutrients** because they are only needed in very small quantities. Regardless of the quantity needed by the body, each nutrient has a different role to play and all are important for health and development.

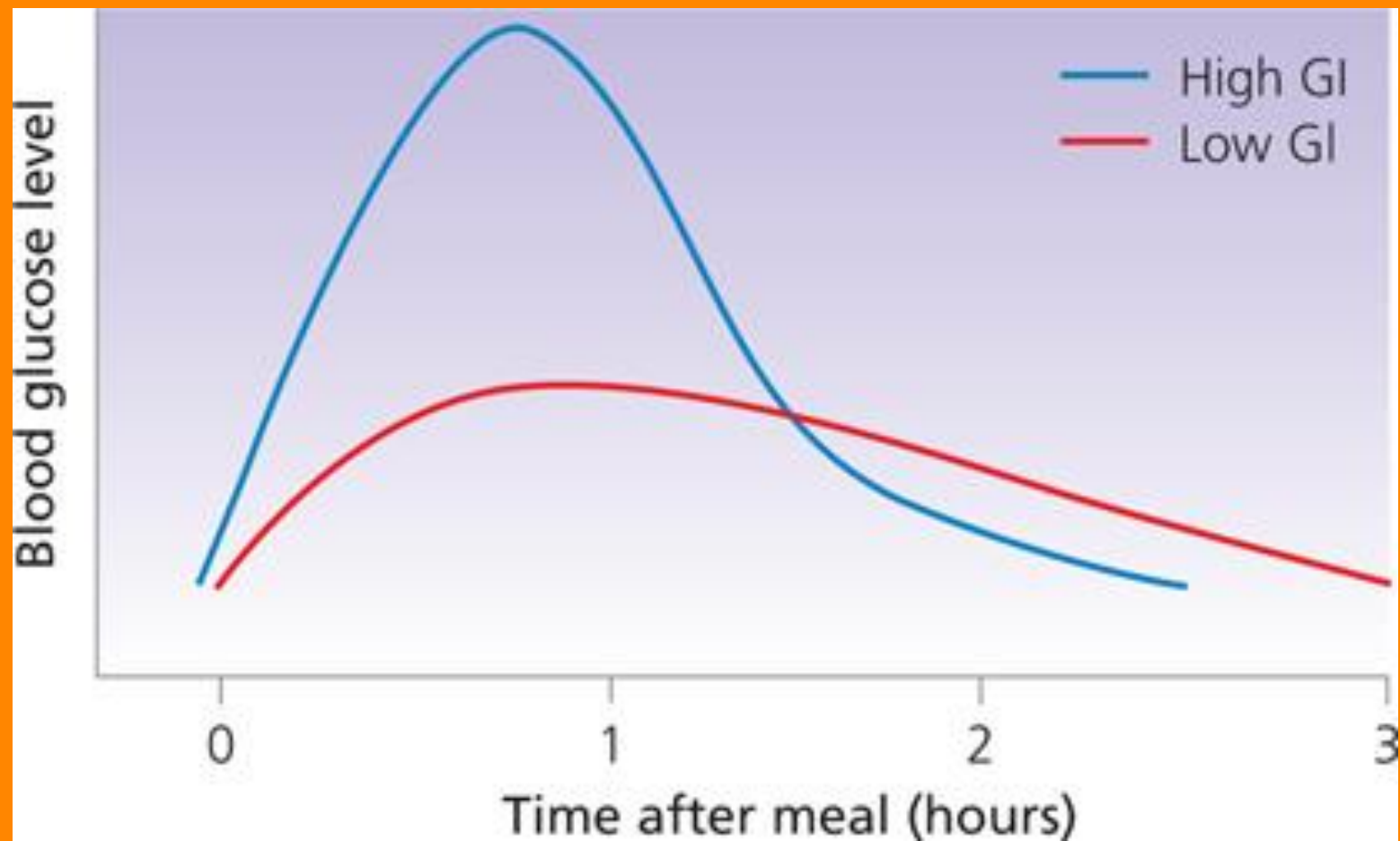
CARBOHYDRATES

- **The main function of carbohydrates is to provide fuel for energy.** As youth are growing at a rapid rate, a lot of energy is required for metabolism and growth. Glucose is the preferred fuel for energy in the human body, and carbohydrates are rich in glucose. Carbohydrates allow an individual to maintain high activity levels, which can provide opportunities to develop motor skills and also the energy to concentrate at school and therefore develop intellectually.

- Carbohydrates are broken down and the glucose molecules are absorbed into the bloodstream, from where they are taken into the cells and stored, ready for use. In terms of energy production, one gram of carbohydrates will produce 16 kJ of energy.
- Glucose (and therefore carbohydrates) that is not used by the body is stored as adipose (or fat) tissue. If a person eats too much carbohydrate, they can gain weight because this increases the amount of glucose stored as fat. This process can be reversed if glucose is needed by the body.

PLAY!

- Eating foods with a low GI rating gives a more sustained energy release and can therefore assist in carrying out the biological processes required during the day. In contrast, high GI foods give a quick rush of glucose that then drops off just as quickly (Figure 4.3). Low GI foods also tend to provide a longer feeling of 'fullness' and may therefore assist in weight maintenance



CAN YOU NAME SOME SOURCES OF CARBOHYDRATES?

- Brainstorm as a class foods that contain carbohydrates

SOURCES OF CARBOHYDRATES

- Most carbohydrates are found in foods of plant origin. **Common examples are potatoes, rice, pasta, most breakfast cereals and fruit.**
- Examples of carbohydrates grouped according to their GI are:
- low GI foods (GI of 55 or less) — most grain breads, oats, muesli, bran, pasta, soybeans, peas and beans, most fruits, cauliflower, broccoli, carrot, squash, milk and yogurt, ice-cream
- medium GI foods (GI in the range 56–69) — table sugar, raisins and sultanas, basmati rice
- high GI foods (GI of 70 or more) — white bread, potatoes (boiled and baked), white rice, some breakfast cereals, most softdrinks, French fries.



FIGURE 4.4 Pasta is a good source of carbohydrates.

FIBRE

- Fibre is a type of carbohydrate that is required for the optimal health and development of youth. Found in all foods of plant origin, fibre does not get absorbed by the body. Rather, it travels through the digestive system, acting like a cleaner as it moves. The benefits of fibre in the diet are numerous for youth:
- Fibre acts to reduce the amount of glucose that is absorbed by the digestive system, thereby reducing the energy provided by the foods eaten. It also provides a feeling of fullness (satiety), so decreases the amount of energy consumed from other foods. Both of these characteristics of fibre assist in weight maintenance.

- Fibre reduces the amount of cholesterol that is absorbed by the body, which reduces the risk of cardiovascular disease later in life.
- Foods containing fibre are generally high in vitamins and minerals, which improves overall nutrient intake. This is particularly important for youth as their nutritional requirements increase due to the growth they experience.
- Fibre absorbs water, which adds bulk to the faeces. This assists in regular bowel movements, which decreases the chances of becoming constipated.

- According to the National Medical and Research Council, youths should be consuming between around 22–28 grams of fibre per day.
- Examples of foods that contain fibre are:
 - 3/4 cup bran flake cereal (4.5 grams of fibre)
 - two slices wholemeal bread (4.5 grams of fibre)
 - one apple and one orange (5.5 grams of fibre)
 - two cups mixed raw vegetables (10 grams of fibre)
 - 1/4 cup baked beans (3 grams of fibre).
- As fibre absorbs water, if the amount in the diet is increased, water consumption should also be increased.



FIGURE 4.5 Grains and seeds are an excellent source of fibre.

PROTEIN

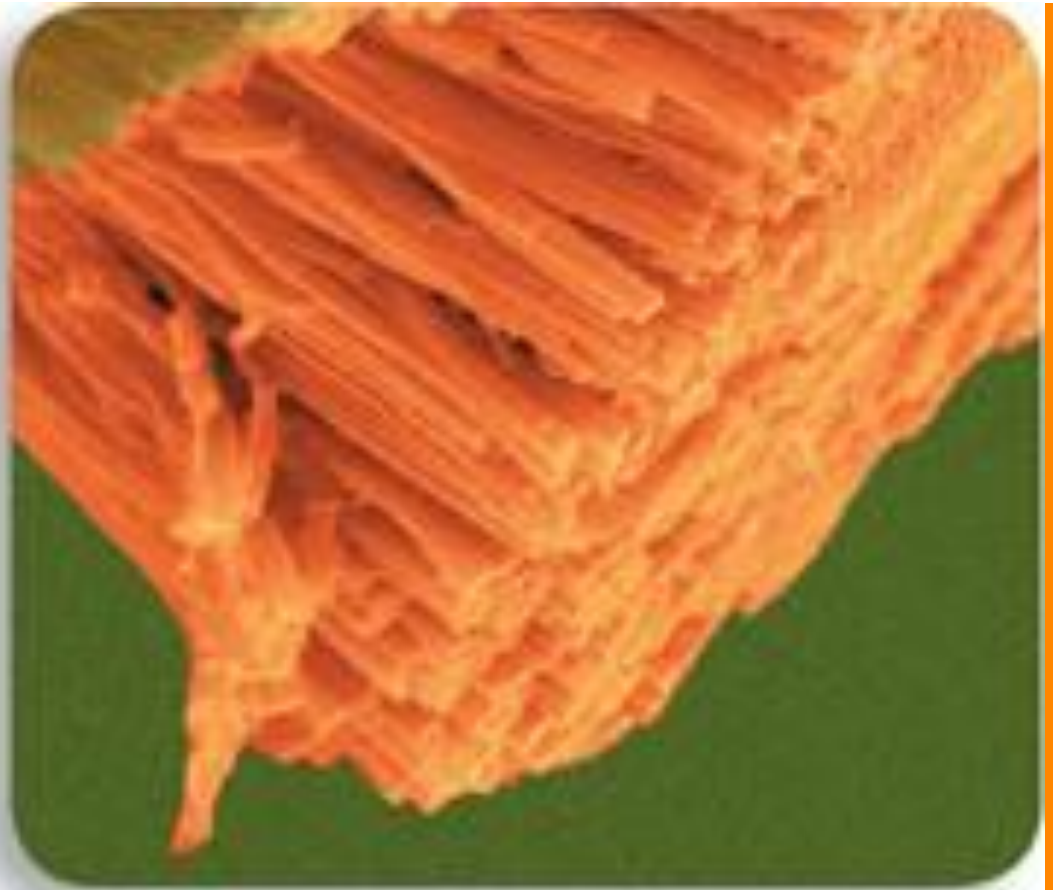
Protein has two main functions in the body.

- Its main function (and probably the most important for youth development) is to build, maintain and repair body cells. This includes the cells required to build muscles, organs, bone and blood (Figure 4.8).
- The second function of protein is to act as a fuel for producing energy. If a person does not have enough glucose (from carbohydrates) to use for energy production, protein can be used as a secondary source of energy. In times of starvation, muscle and other body cells may be broken down so the protein contained within them can be used for energy. Protein yields about 17 kJ per gram when being used for energy.

- Protein is made up of smaller building blocks called amino acids. There are 20 different types of amino acids that humans need to function properly. Eleven of these, called the non-essential amino acids, can be synthesised (or made) in the body from other amino acids. The other nine, called essential amino acids, cannot be synthesised in the body and must therefore be consumed (figure 4.11).

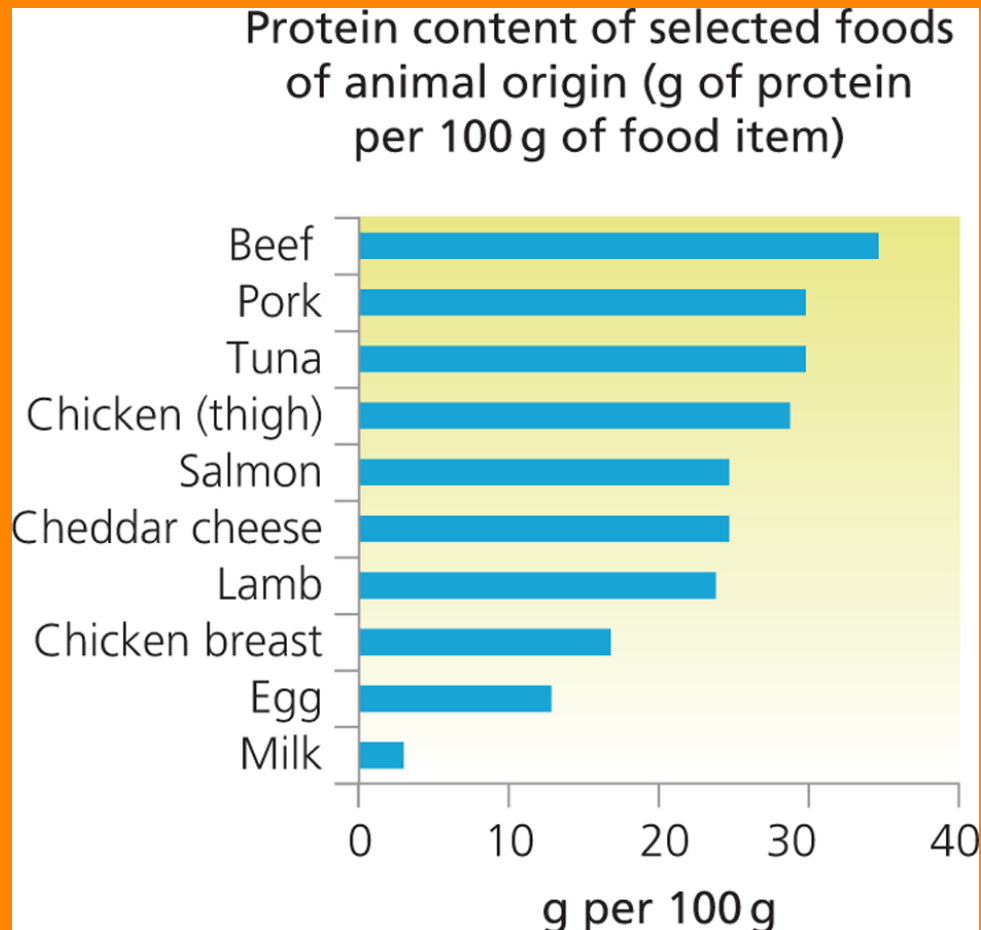
- To ensure that all amino acids are being consumed regularly, protein from a range of different sources should be eaten. Many people get much of their protein requirements from meat, which is often rich in essential amino acids. Vegetarians must ensure they consume a large variety of non-meat protein sources to ensure that their nutritional needs are being met.

FIGURE 4.8 Protein is a key component of all body tissues, like these muscle fibres.



SOURCES OF PROTEIN

- Some food sources are termed ‘complete proteins’ because they contain the essential amino acids in the quantities required for individual human development. They are usually found in vast amounts in animal products (figure 4.9). Some proteins can also be found in many foods of plant origin (figure 4.10). These are usually incomplete proteins and need to be eaten with other protein sources to ensure that all required amino acids are consumed.



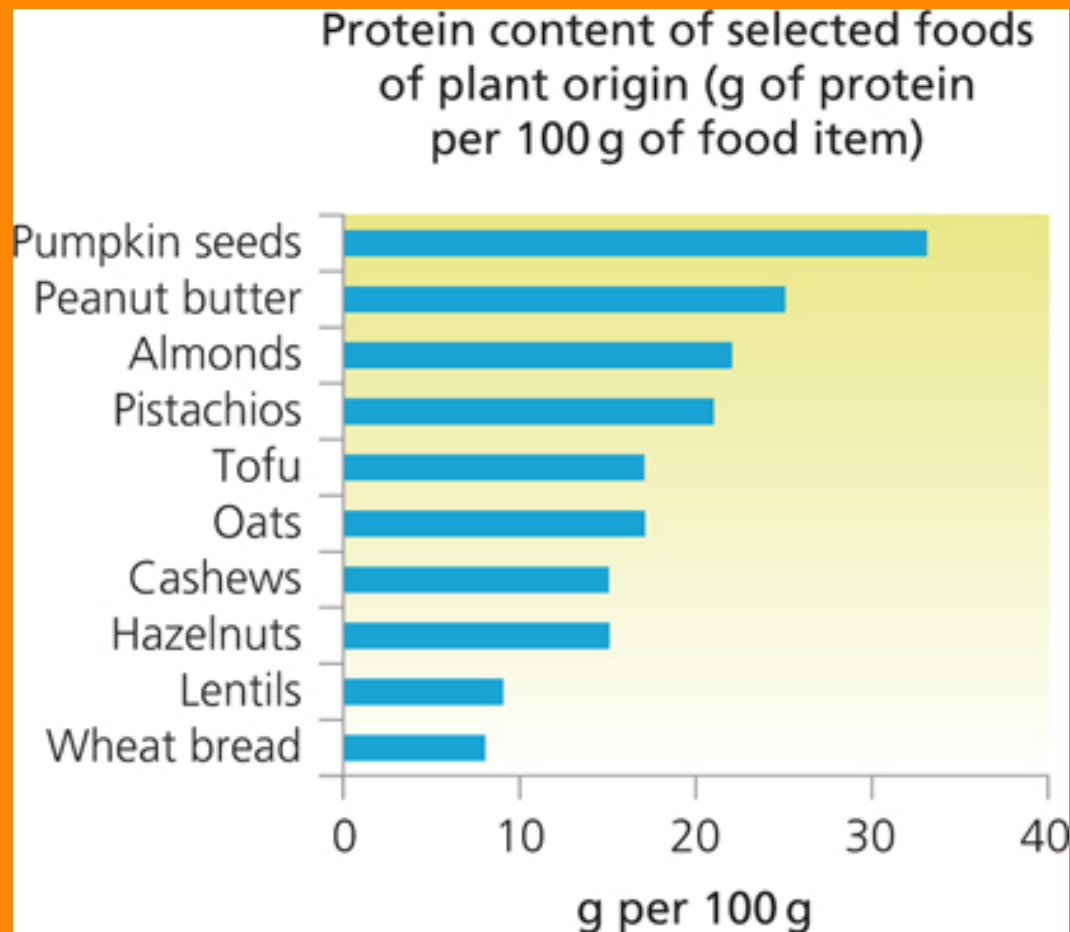


FIGURE 4.10 The protein content of selected foods of plant origin

LIPIDS (FATS)

- **Lipids (commonly referred to as fats) play a number of roles in youth health and development. Although lipids are often associated with negative effects on the body, they are required for adequate development throughout the lifespan and are an essential part of a balanced food intake.**

- Like carbohydrates, the main function of lipids is to act as a fuel for energy. Lipids are a richer source of energy compared to carbohydrates and protein, yielding 37 kJ per gram. This is why foods packed with fat but little else are referred to as 'energy dense' foods. How much fat to include in the diet should be determined by the amount of energy required by the individual. Balance is the key here. Remember that most of an individual's energy should come from carbohydrates.

- **Lipids are required for a number of other processes including the development and maintenance of cell membranes. Cell membranes form an important component of body cells. They are responsible for maintaining the structure of cells and allowing the transport of nutrients, gases and waste into and out of cells. Lipids are a key component of the cell membrane and are required throughout life for adequate cell function.**

- Fat-soluble vitamins (A, D, E, K) need lipids to transport them around the body so that these vitamins can carry out their functions. Lipids have insulating properties that are needed in the maintenance of body temperature. (Those with low body-fat levels are more susceptible to the effects of a cold environment.) By providing cushioning, lipids also act to protect the vital organs from knocks and bumps.

- Lipids are obviously an important part of a balanced diet for youths, but there are different types of lipids and some are healthier than others. Some lipids can actually lead to poor health and should be kept to a minimum in the diet.

- Based on their chemical make-up, lipids can be classified into four broad categories: monounsaturated, polyunsaturated, saturated and trans fats. Total fat intake should account for around 25 per cent of the total energy requirement (with carbohydrates and protein making up the other 75 per cent). Of this 25 per cent, the majority should come from monounsaturated fats. Approximate recommended percentages of total energy intake from the different types of macronutrients are shown in figure 4.12.

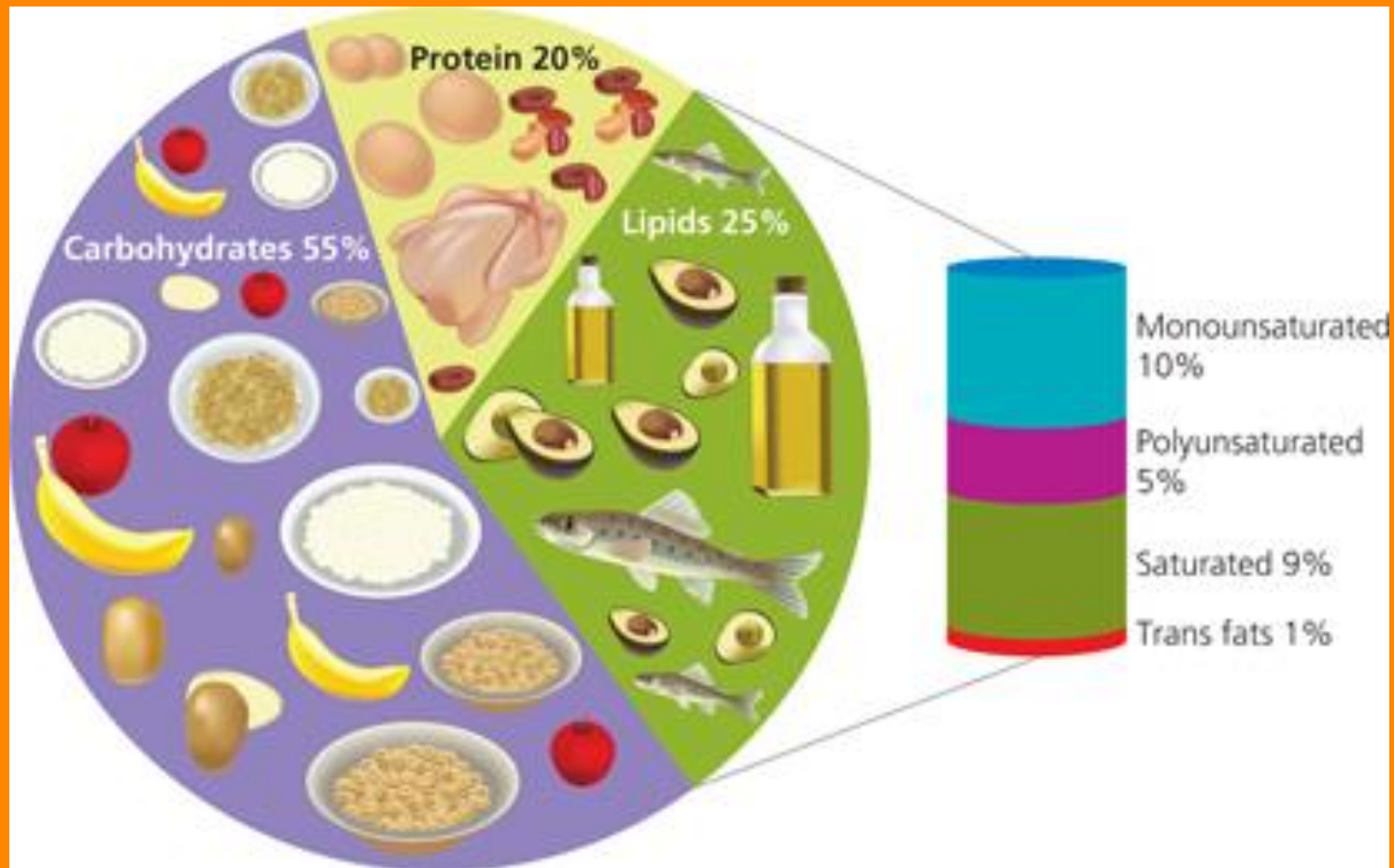


FIGURE 4.12 Macronutrients (with a breakdown of lipids), and the average percentage of total energy intake each should make up (approx)

MONOUNSATURATED

- **Monounsaturated fats are considered one of the ‘good fats’. They have some health benefits and so are the preferred choice in meeting the fat requirements of developing youth. They should be consumed in the highest proportion of all the fats.**
- **Monounsaturated fats are liquid at room temperature and begin to solidify if placed in the refrigerator. Foods rich in monounsaturated fats include olive oil, avocado, canola oil, nuts, and peanut butter.**
- **Because all fats contain 37 kJ of energy per gram, all will lead to weight gain and the associated effects on health if eaten in excess.**

POLYUNSATURATED

- Polyunsaturated fats are also considered to be one of the 'good' fats. They can help reduce the risk of diet-related diseases later in life such as heart disease. There are two main categories of polyunsaturated fats: omega-3 and omega-6.
- Omega-3 and omega-6 polyunsaturated fats have been linked to a number of benefits including the prevention of cancer and cardiovascular disease, and to increased immune system function. Perhaps the most important role of these fats for youth development is related to brain function. Some studies suggest that they can improve memory and concentration, and can therefore assist with intellectual development.

- Polyunsaturated fats are generally liquid at room temperature and when refrigerated. Food sources for these fats include:
- omega-3 — fish (particularly oily fish such as mackerel, trout, sardines, tuna and salmon), canola and soy oils and canola-based margarines
- omega-6 — mainly nuts and seeds and oil made from corn, safflower and soy.

- Many people in Western countries consume too many omega-6 fats which, like all fats, can increase the risk of obesity and associated conditions including heart disease. Achieving a balance in polyunsaturated fat intake is essential if the associated benefits are to be gained. Researchers recommend eating omega-3 and omega-6 fats in a ratio of 1:4 for optimal development. Many people eat them in a ratio of around 1:10 (too much omega-6 and not enough omega-3).



FIGURE 4.13 Nuts are a great source of the ‘good’ fats.

SATURATED

- Saturated fats are sometimes known as ‘bad fats’ because they increase cholesterol levels in the blood and can therefore contribute to heart disease in the long term. Although consuming saturated fats will satisfy the energy and other requirements provided by other types of fats, saturated fats should be replaced where possible.

- Saturated fats are generally found in foods of animal origin (figure 4.14) and are often solid at room temperature. You can see saturated fat in fatty cuts of meat as the marbling throughout the meat or the fat that forms along the ends of cuts of red meat. Other foods containing high levels of saturated fat include full-cream milk, cream and cheese, most fried takeaway food, and most commercially baked goods such as pastries and biscuits.

FIGURE 4.14 Fats that come from animals and are solid at room temperature are normally saturated. This pork fat is one example.



TRANS FATS

- Trans fats are much like saturated fats in that they can contribute to heart disease and other diet-related diseases. As with saturated fats, they should be avoided wherever possible or eaten in minimal amounts only. Although small amounts of trans fats are found naturally in certain foods, most trans fats are created when liquid oil is converted into solid fat by a process called hydrogenation. For this reason, they are generally found in processed foods such as pies, pastries and cakes (figure 4.15). Margarine and solid spreads made for cooking are sometimes high in trans fats, as are the products made from them.



FIGURE 4.15 Trans fats are often present in baked goods such as doughnuts, biscuits and cakes.

ACTIVITY

- Complete Activity 5.1 page 116 of textbook

WATER

- Although having no nutritional value, water is the most important nutrient for human survival. Water makes up around 55 to 75 per cent of body mass and is needed for numerous functions within the body, including:
- as a medium for all chemical reactions
- as an aid to digestion and waste removal
- for temperature control
- as a key component of many cells, tissues and systems
- as a key component of blood
- for muscular contractions
- for fluids that cushion the joints (synovial fluid).

- Being adequately hydrated allows chemical reactions in the body to occur effectively, which is important for periods of rapid development such as the youth stage of the lifespan. Sufficient water intake allows the body's systems to function adequately and the body as a whole to function properly. This means an individual can effectively go about their day-to-day activities.

- When dehydrated, a person will often lack alertness and the ability to concentrate. This can affect development in a number of ways.
- They may not have the energy to participate in physical activities, which can impact on motor skill development.
- They may not socialise effectively, and may therefore miss out on opportunities for social development such as furthering communication skills.
- They may not be able to concentrate at school, which can directly impact on intellectual development.

- All foods have some water content (figure 4.16) and contribute to total water intake, as do fluids such as milk. Water should also be consumed in its pure form (i.e. from the tap or in bottled form) to meet hydration needs. Although they contain a large percentage of water, softdrinks and sports drinks often contain high amounts of sugar and other additives so their consumption should be limited.



FIGURE 4.16 Foods such as fruits and vegetables have a high water content, but water should also be consumed in its pure form.

TODAYS LESSON

Title: Understanding the functions and food sources of nutrients required for optimal health and development of youth

-Micronutrients

Success Criteria:

I understand the functions and food sources of micronutrients required for the optimal health and development of youth

CALCIUM

- Calcium is one of the key nutrients required for the building of bone and other hard tissues (such as teeth and **cartilage**) and is therefore extremely important during periods of rapid growth such as during youth.
- The youth stage signifies the greatest increase in bone density and contributes significantly to achieving optimal **peak bone mass**. It is therefore vital that youth get enough calcium during these years to build as much bone density as possible. The greater the bone density during this stage, the less chance the individual will have of developing **osteoporosis** later in life (figure 4.17).

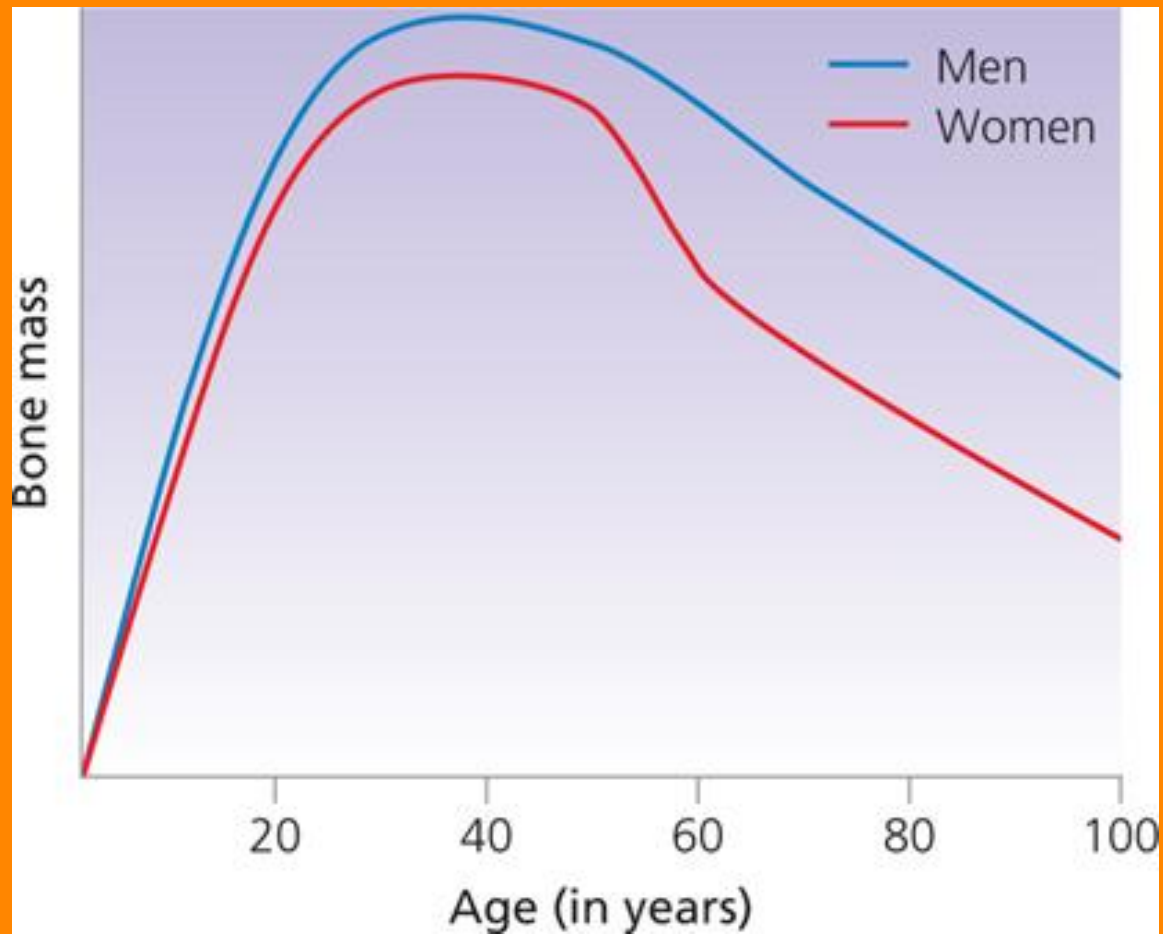
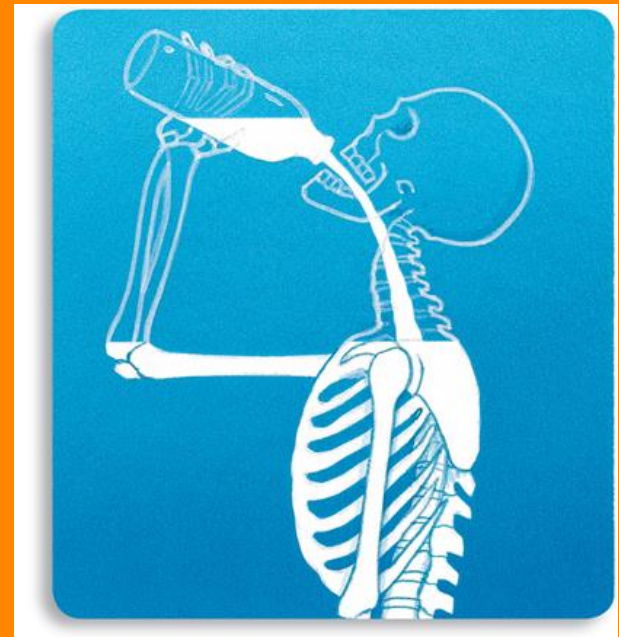


FIGURE 4.17 Changes in bone mass with age

- Calcium is found in dairy products (figure 4.18). Milk, cheese and yogurt are all rich sources of calcium. Other sources include sardines and salmon (with bones), green leafy vegetables (broccoli, spinach), **fortified** soy milk, tofu made with calcium sulfate and fortified orange juice.

FIGURE 4.18 Dairy products such as milk are a rich source of calcium and help to build peak bone mass.



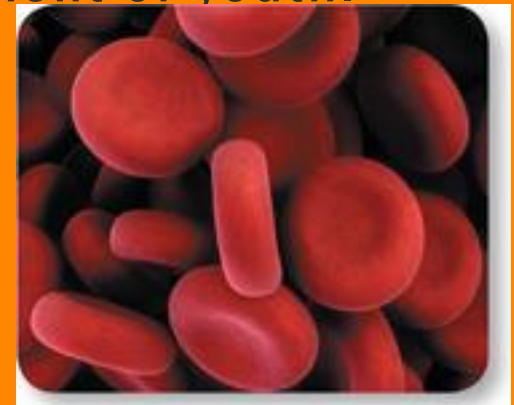
CASE STUDY

- Complete Case Study- calcium

IRON

- Iron is an essential part of blood. As blood volume increases during youth, iron is needed in greater quantities (figure 4.19).
- Iron forms the 'haem' part of **haemoglobin**, which is the oxygen-carrying part of blood. A person who does not get enough iron may develop **anaemia**, a condition that is characterised by tiredness and weakness. Such symptoms could have serious effects on the development of youth.

FIGURE 4.19 As blood volume increases during the youth stage of the lifespan, iron is required in higher amounts to make red blood cells.



- **Anaemia may affect development by creating:**
- **an inability to participate in the weight-bearing activities that are needed to increase bone density, which can result in reduced bone mass**
- **an inability to participate in physical activity, which can impair motor skill development**
- **insufficient energy to have a part-time job, which can affect social development such as learning the role of an employee**
- **an inability to concentrate in class, which can hinder intellectual development because vital knowledge is not gained**
- **constant feelings of tiredness, which may generate a range of negative emotions such as helplessness and isolation.**

Red meat is a rich source of iron but it often contains high levels of saturated fat. As a result, lean cuts of meat should be chosen and iron should also be gained from other sources. A balanced, varied diet is the best way to get adequate amounts of iron.

Foods providing iron include:

- lean red meat
- turkey and chicken
- fish, particularly oily fish (e.g. mackerel, sardines and pilchards), fresh, frozen or canned
- eggs
- nuts (including peanut butter) and seeds
- brown rice
- tofu
- bread, especially wholemeal or brown bread
- leafy green vegetables, especially curly kale, watercress, and broccoli.

- Iron from meat is usually absorbed best, although vegetarians can still get enough iron if they eat a variety of foods. Vitamin C changes the chemical make-up of iron from non-meat sources and increases the amount absorbed. Vitamin C should therefore be included as part of a meal if high amounts of iron are being consumed.

CASE STUDY

- Complete Case Study- anaemia

KEY NUTRIENTS DURING YOUTH: VITAMINS A, B, C AND D



VITAMIN A

- **Vitamin A is fat-soluble, which means it needs fat to transport it around the body. Vitamin A is essential for many aspects of normal development, particularly for normal vision. It is an essential part of many cells within the eye, and helps to convert light signals into nerve signals in the retina. A lack of vitamin A can lead to reduced vision, which is often first noticeable when the eyes have trouble adjusting to environments with low light (called night blindness).**

- **Vitamin A is required for cell division and is therefore an important aspect of any growth that occurs in the body. There are many aspects of physical development that involve growth during the youth stage of the lifespan, so requirements for vitamin A increase at this time. Skin, muscle, organ, bone and blood cells all divide rapidly during youth and therefore require vitamin A.**

- Vitamin A also plays a role in **cell differentiation**. Due to the rapid speed of growth during youth, cell differentiation occurs at a rapid rate and contributes to the increased need for this vitamin. Vitamin A has also been shown to promote the development of bones.
- Vitamin A assists with the development of immune system function by promoting mucus development in the lungs and airways. This lining of mucus is a defence mechanism against bacteria and viruses. Vitamin A also helps in the development of antibodies required to fight infection.
- **The best sources of Vitamin A can be found in red, yellow and orange coloured fruits and vegetables including raw carrots, sweet potatoes, squash, spinach, and cantaloupe (figure 4.20).**



FIGURE 4.20 Yellow, orange and red fruit and vegetables are good sources of vitamin A.

VITAMIN D

- Vitamin D is another fat-soluble vitamin and its main role is in the absorption of calcium from the intestine into the bloodstream. Lack of vitamin D can lead to low levels of calcium being absorbed and bones becoming weak.
- Fish (e.g. tuna, salmon, mackerel, sardines and herring) is the best source of food-based vitamin D. Fortified milk, breakfast cereals and orange juice can also contain vitamin D, but read the packaging to be sure.

- Most Australians get enough vitamin D from exposure to sunlight (figure 4.21), a process in which UV rays are converted to vitamin D in the skin. However, there is growing evidence to suggest that some groups in Australia are deficient in vitamin D because they rarely go out into the sun. The residents of nursing homes are most at risk, but people with dark skin or those who always cover up when outdoors can become deficient in vitamin D. While moderate exposure without any degree of sunburn is healthy, excessive exposure leading to sunburn is a major risk factor for skin cancer and should always be avoided.



FIGURE 4.21 Most Australians get enough vitamin D from exposure to sunlight, but those with restricted access to sunlight might be deficient.

VITAMIN C

- **Vitamin C is important for the structure of tissues within the body and is required for building collagen.** Collagen is a protein that is required for the formation of skin, scar tissue, **connective tissue**, bone, tendons, ligaments, and blood vessels (Figure 4.22). In this role, vitamin C allows the other components of tissues to be held together.



FIGURE 4.22 Collagen is a key component of these tendons.

- Humans can neither make their own vitamin C in the body nor store it effectively (as other animals can do). Therefore, a daily intake of vitamin C is important for normal development and functioning.
- **Vitamin C is found in many fruits and vegetables including kiwi fruit, broccoli, blackcurrants, oranges and strawberries.** It is easily destroyed when exposed to heat and air, so fresh fruit and vegetables provide the best source of vitamin C.

B-GROUP VITAMINS

- **Vitamins B1, B2 and B3**
- **The B-group vitamins include vitamins B1, B2 and B3 (also known as thiamine, riboflavin and niacin respectively). These vitamins are essential in the process of metabolising or converting the fuels (carbohydrates, fats and protein) into energy.**
- **A lack of these nutrients can lead to a lack of energy. As energy is essential for growth, a lack of the B-group vitamins can contribute to slowed growth. Energy is also required for carrying out daily activities such as socialising and attending school. Lack of energy may mean that these tasks are not carried out effectively, and physical, social, emotional and intellectual development can all be compromised as a result.**

- Rich sources of the B-group vitamins include Vegemite, wholegrain cereals and breads, eggs, meats, fish, dark-green leafy vegetables and milk. The B-group vitamins are very delicate and easily destroyed through cooking and processing. Getting enough of these vitamins from whole grains and unrefined sources is the best way to ensure that the recommended intake of these vitamins is met.

VITAMIN B6

- Vitamin B6 (also called pyridoxine) is another B-group vitamin that is required for the metabolism of carbohydrate and protein. It also plays a role in brain development because it is essential for the formation of certain brain chemicals. As a result, it is important during times of rapid intellectual development during youth. Vitamin B6 also plays a role in red blood cell development. A lack of vitamin B6 is associated with depression, insomnia, anaemia, irritability and confusion.
- Rich sources of vitamin B6 include cereals, grains, legumes, green leafy vegetables, fish, meat, poultry, nuts, liver and fruit.

FOLATE (VITAMIN B9)

- Folate is a B-group vitamin that is essential for growth and development. It plays an important role in DNA synthesis and is therefore required for cells to duplicate in periods of growth. (It also occurs in periods of maintenance, but not to the same degree.) Folate also plays a role in the development of red blood cells, and a deficiency in folate can lead to anaemia.
- Folate is found in green leafy vegetables, citrus fruits, poultry and eggs. Many cereals, breads and fruit juices are fortified with folate in Australia. The form of folate added to foods is a synthetic form of folate known as folic acid.



FIGURE 4.23 A lack of folate can lead to anaemia and therefore tiredness. This can have numerous effects on the development of youth.

VITAMIN B12

- **Vitamin B12** is another B-group vitamin that is required for adequate development during youth. Although it has a number of roles in the body, **its main function during the youth stage is for the formation of red blood cells.** It works with folate in this capacity, ensuring the red blood cells are not only the correct size but also the correct shape to enable oxygen to be transported throughout the body. A deficiency of vitamin B12 can increase the chance of getting anaemia. Having this condition can prevent youths from participating in normal activities and therefore have a wide range of effects on their development.

- **Most foods of animal origin contain some vitamin B12 but particularly good sources include meat, eggs and cheese. Because vitamin B12 is found only in food sources of animal origin, vegans are at particular risk of being deficient in this vitamin.**

ACTIVITY

- Complete Activity 5.2 page 121

HOMEWORK

- **Complete Activity 5.3 page 121**